NASA SBIR/STTR Technologies

X5.05-9236 - High Performing PFPE Nanofluid Lubricants

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Identification and Significance of Innovation

Future success of long-duration, planetary space exploration requires lubricants that can perform effectively over extended lifetimes with minimal or no maintenance in aerospace systems. These systems include rovers and machinery used in constructing the lunar habitat, and bearings in gyroscopes on board satellites. Lubricants that are intended for space-use must have a low vapor pressure, be chemically stable, function over a wide temperature range, exhibit low friction coefficients, produce small wear effects, and limit corrosion processes.

Expected TRL Range at the end of Contract (1-9): 3-4

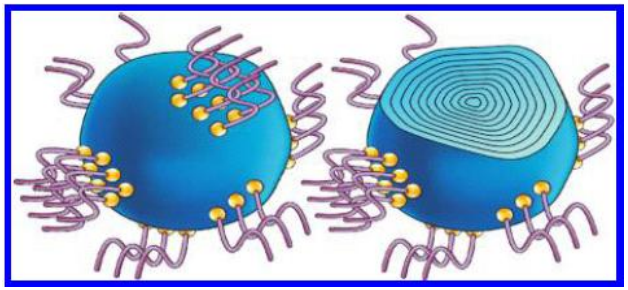

Figure 1. Cartoon of PSI's proposed additive.

Technical Objectives and Work Plan

The specific objectives were as follows:

- Prepare novel additives
- Demonstrate that the additives are thermally stable ± 65°C
- Show a 50% reduction in friction and wear at a steel surface upon addition of the particles to PFPE
- Demonstrate no change in viscosity of PFPE upon formulation with an additive
- Show no agglomeration of the additives within PFPE, and that that the additives would have settling times > 5 years

We proposed the following 6 tasks designed to meet each objectives:

- Task 4.1 – Management and Reporting
- Task 4.2 – Additive Synthesis
- Task 4.3 – Additive Characterization
- Task 4.4 – Tribological Measurements
- Task 4.5 – Rheological Investigations
- Task 4.6 – Settling Time Estimation

NASA and Non-NASA Applications

Potential NASA Commercial Applications: The proposed lubricants and formulations will have direct applications to NASA aerospace systems that require minimal/no maintenance over extended periods of time such as rovers and satellites.

Potential non-NASA Commercial Applications: The proposed lubricants and formulations have applications in terrestrial machinery. They will substantially increase performance, and reduce maintenance costs and frequencies of industrial transportation and construction systems. The compounds will also be valuable in gyroscope bearings on board satellites.

Firm Contacts

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